LIFE URBANGREEN

EFFICIENT URBAN GREEN MANAGEMENT TOOLS FOR ADAPTATION TO CLIMATE CHANGE

Paolo Viskanic, Gianluca Antonacci, Francesco Ferrini, Alessio Fini, Alice Pasquinelli and Piotr Wezyk

R3GIS managing spaces Anthea

Kraków Municipal Greenspace Authority

ProGea4P

UNIVERSITÀ DEGLI STUDI DI MILANO

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With the contribution of the LIFE Programme of the European Union. **LIFE17 CCA/IT/000079**

Project coordination

Paolo Viskanic

CEO of R3 GIS

Degree in Tropical and Subtropical Agriculture

Project Coordinator LIFE UrbanGreen

R3GIS managing spaces

Software company specialized in environmental platforms for smart cities

Team of 20 people, based in Bolzano, South Tyrol, Italy

Operating in Italy, Austria, Germany, Switzerland, Poland, Finland, Slovenia, Hungary, Taiwan

ISA

Vision

Help cities around the world to manage their green infrastructure efficiently and safely to improve the quality of life and help them to adapt to the effects of climate change.

The LIFE URBANGREEN Project

The LIFE programme

European funding instrument to support projects focused on

Environment sub-programme

- Nature and biodiversity
- Environment and resource efficiency
- Environmental governance and information

Climate action sub-programme

- Climate change mitigation
- Climate change adaptation
- Climate governance and information


LIFE URBANGREEN
INNOVATIVE TECHNOLOGICAL PLATFORM TO IMPROVE MANAGEMENT OF GREEN AREAS FOR BETTER CLIMATE ADAPTATION
Life
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Kraków
ProGea
R3GIS
managing spaces
Kraków
Municipal Greenspace
Authority
Rimini
Anthea
UNIVERSITÀ
DEGLI STUDI
DI MILANO
€ 2.5 M Total budget
€ 1.3 M EU contribution
07/2018
12/2021

Three main project pillars

RESEARCH

- Leaf transpiration measurements
- Pollutant deposition analysis
- LiDAR survey
- Meteo data analysis
- IOT sensors integration
- Satellite data analysis

SOFTWARE TOOLS

- Ecosystem services calculation
- Meteo data integration
- Smart irrigation tool
- IOT sensors integration
- Improved job planning
- Public portal for citizens

TEST ON PILOT SITES

Test new tools and assess effect of best practices on trees:

- Target pruning
- Irrigation
- Soil decompaction
- Mulching

Sites and species

Kraków

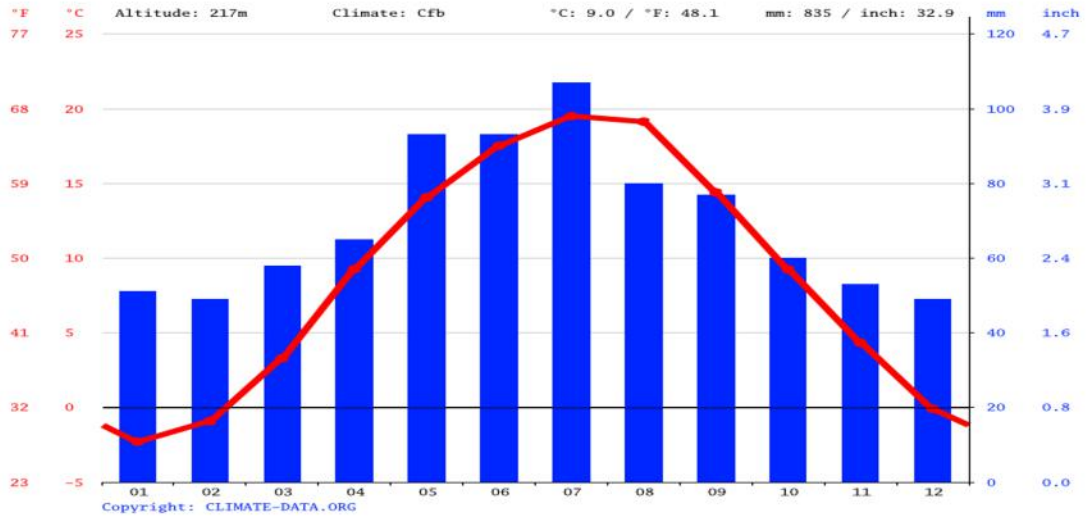
Zarząd Zieleni Miejskiej w Krakowie

Krakow, Poland

More then 20M m^2 of public green areas with 140.000 trees, distributed among 4300 sites.

Care and management carried out by ZZM, a department of the City of Krakow, with support of external companies and professionals.

Climate zone Cfb (Koppen)



https://en.climate-data.org/europe/poland/lesser-poland-voivodeship/krakow-715022/#climate-graph

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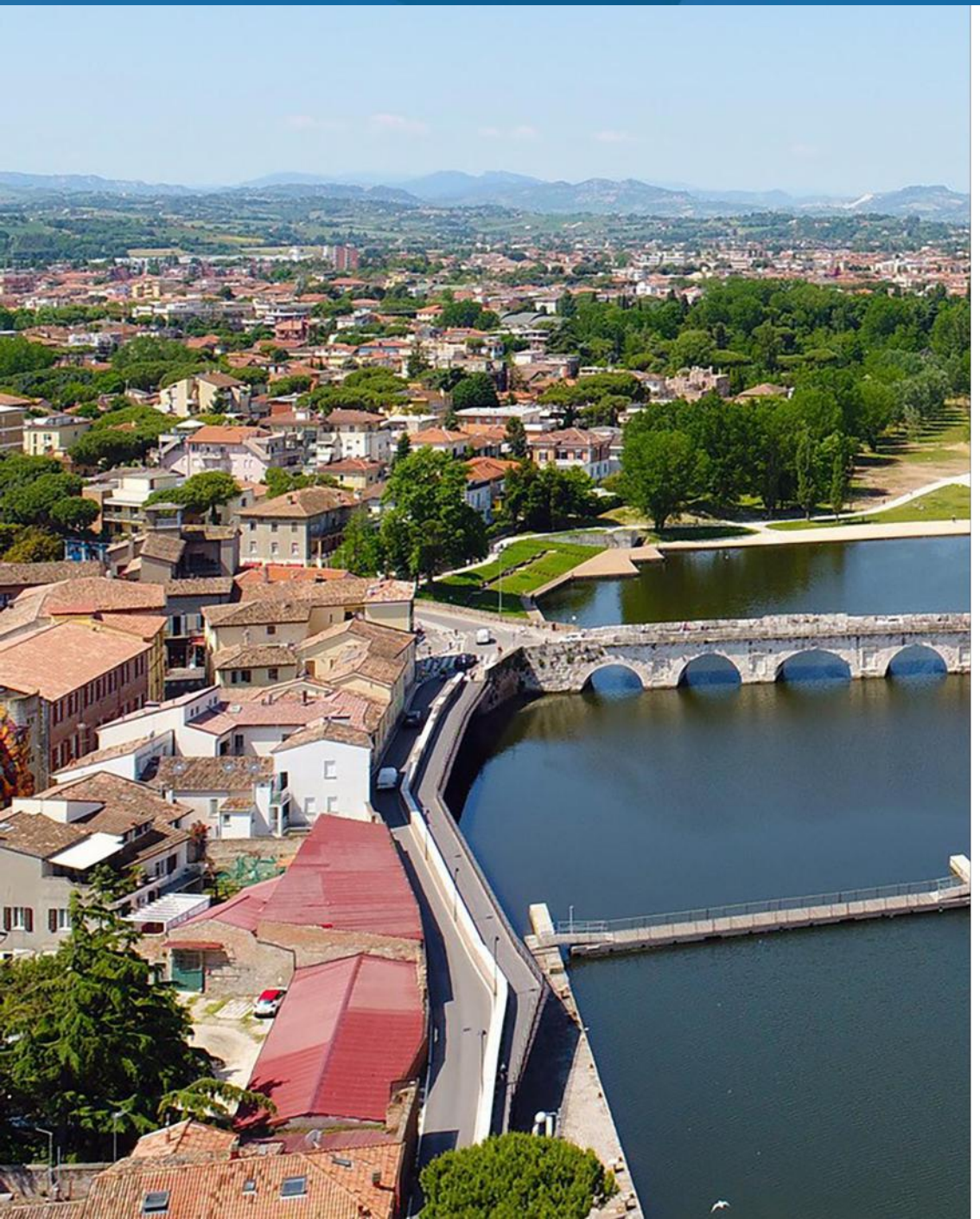


Comune di Rimini

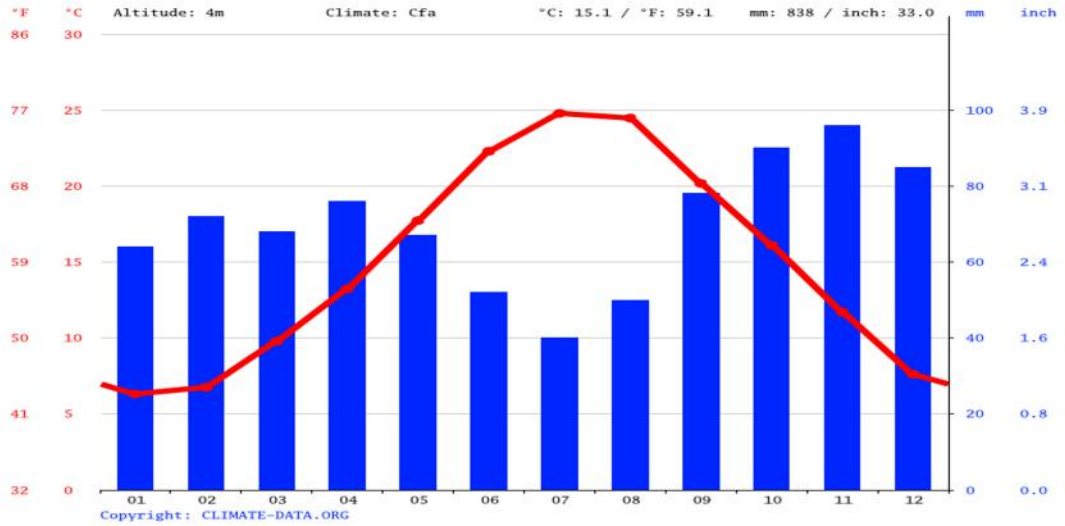
Anthea

Rimini, Italia

More then 2,5M m^2 of public green areas with 50.000 trees, distributed among 1000 sites.

Care and management carried out by Anthea, a public owned company of the City of Rimini and 4 other municipalities, with support of external companies and professionals.

Climate zone Cfa (Koppen)



https://en.climate-data.org/europe/italy/emilia-romagna/rimini-1176/#climate-graph

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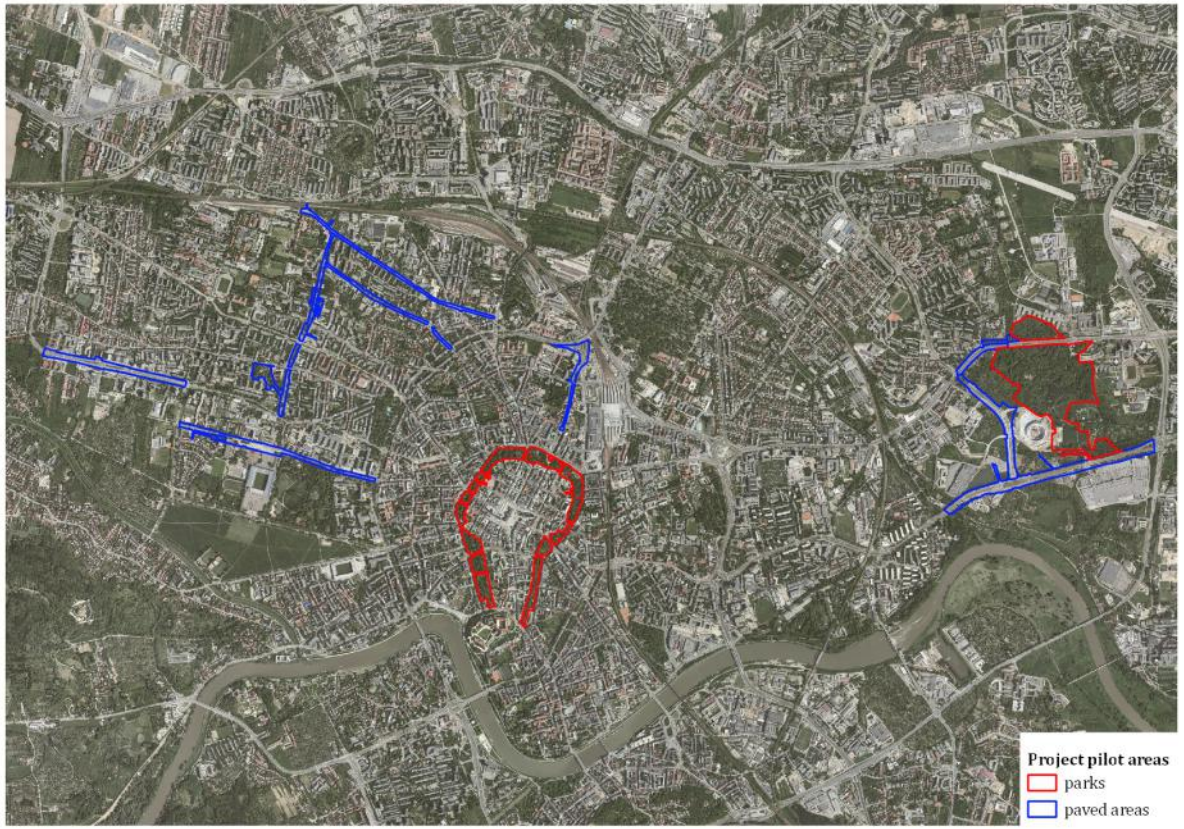
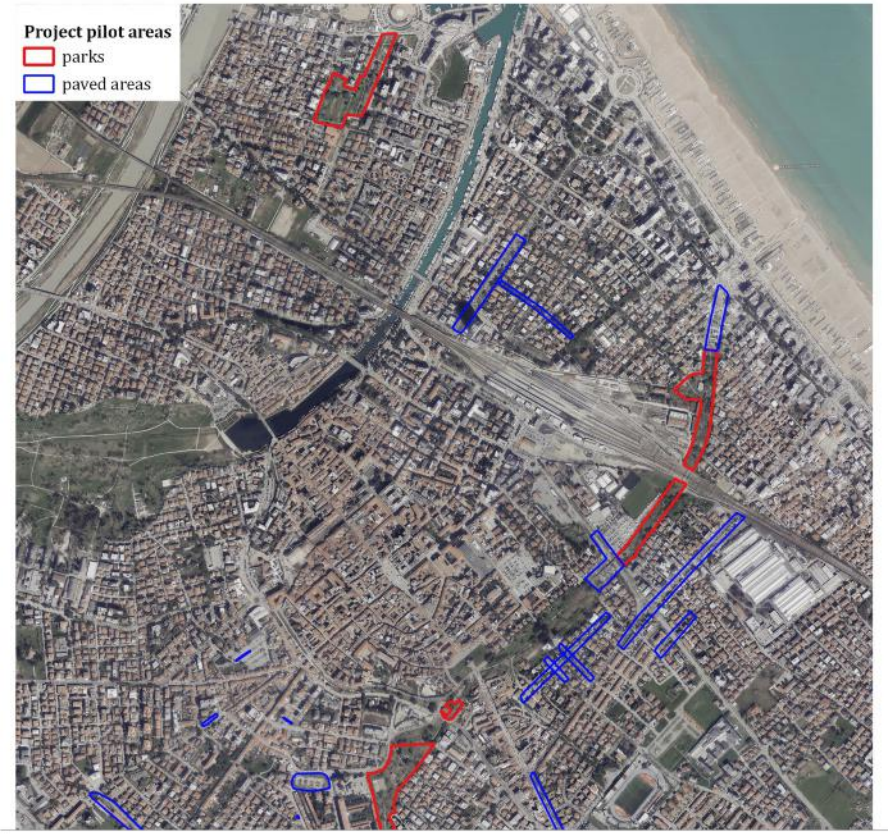
The pilot areas

Kraków (PL): 500 ha



Rimini (IT): 250 ha



The studied species

Kraków (PL): 500 ha

Norway maple
Acer platanoides

Horse chestnut
Aesculus hippocastanum

European ash
Fraxinus excelsior

Rowan
Sorbus aucuparia

Little-leaf linden
Tilia cordata

Austrian pine
Pinus nigra

Pedunculate oak
Quercus robur

Black poplar
Populus nigra

European white elm
Ulmus laevis

White dogwood
Cornus alba

Rimini (IT): 250 ha

Platano
Platanus ×acerifolia

Ippocastano
Aesculus hippocastanum

Tiglio
Tilia ×europaea

Ligustro lucido
Ligustrum lucidum

Pino domestico
Pinus pinea

Farnia
Quercus robur

Acero americano
Acer negundo

Pioppo nero
Populus nigra

Leccio
Quercus ilex

Lauroceraso
Prunus laurocerasus

臺北市政府
Taipei City Government

國立中央大學
National Central University

Taipei, Taiwan

The National Central University of Taiwan decided to participate to the project with its own budget and to use as a pilot site Daan Park in Taipei City.

Main results from Taiwan

The National Central University of Taiwan worked on the effect of typhoons on urban green areas in Taiwan.

ELSEVIER

Urban Forestry & Urban Greening
Volume 63, August 2021, 127191

Evaluation of urban greenspace vulnerability to typhoon in Taiwan

Kim-Anh Nguyen [a, b, c], Yuei-An Liou [a], Trong-Hoang Vo [a, b], Dao Dinh Cham [b, c], Hoang Son Nguyen [d, e]

Pre-project situation


GREENSPACES
Existing Platform to manage urban green areas of the two cities:
Inventory of green areas including trees, VTA management, job management, playgrounds and inspections, etc.
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CENSUS

MAINTENANCE

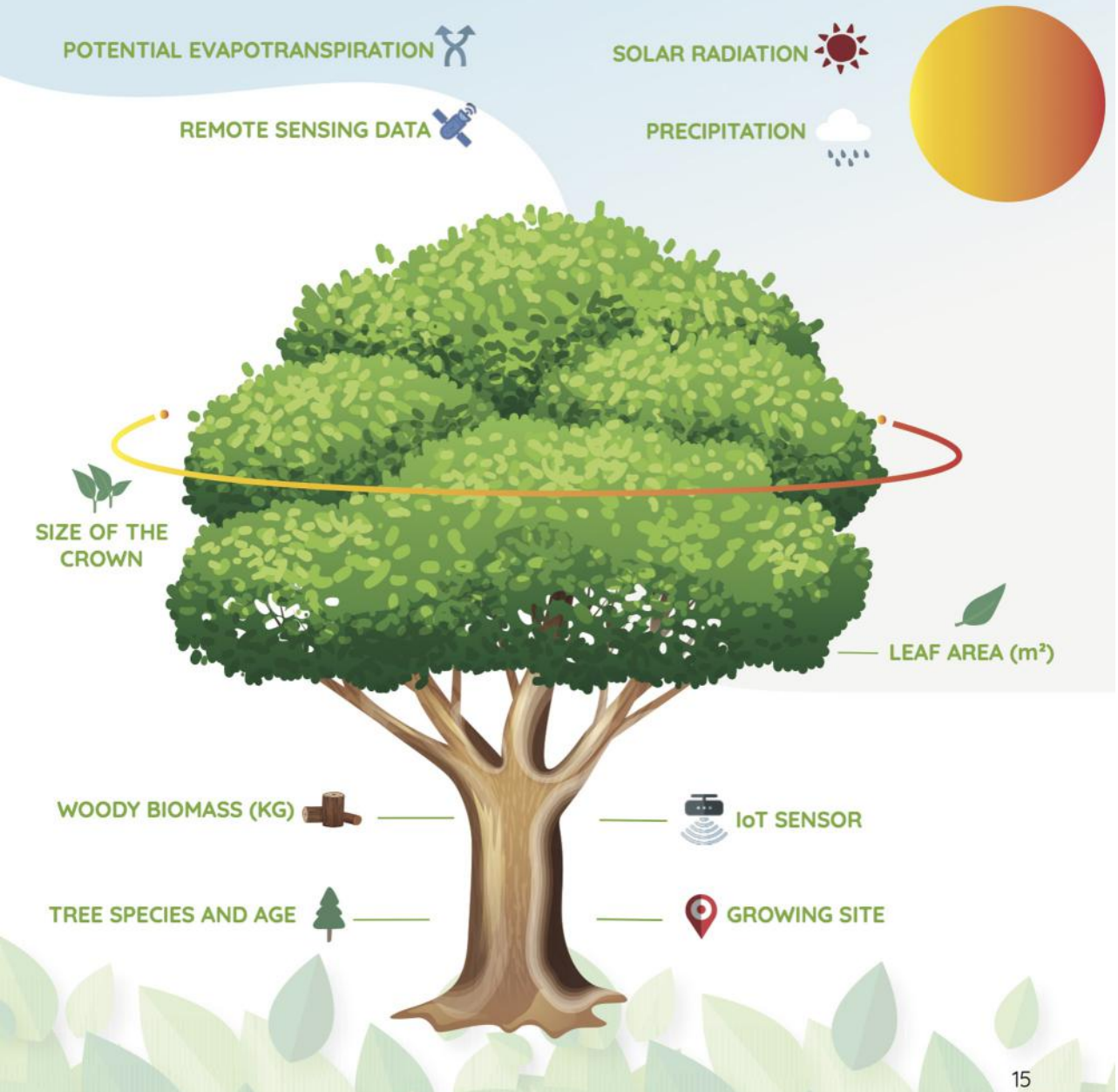
GREEN SPACES

DB

OPERATORS

CITIZENS

The research part



Scientific activities

Carried out by the two partners University of Milano and ProGea 4D with the support of CISMA.

In this presentation we will concentrate on software developments based on scientific research and tests on pilot sites.

Scientific results will be presented by Alessio Fini

How Trees Improve Cities: CO_2 Uptake, Cooling, Air Quality Amelioration

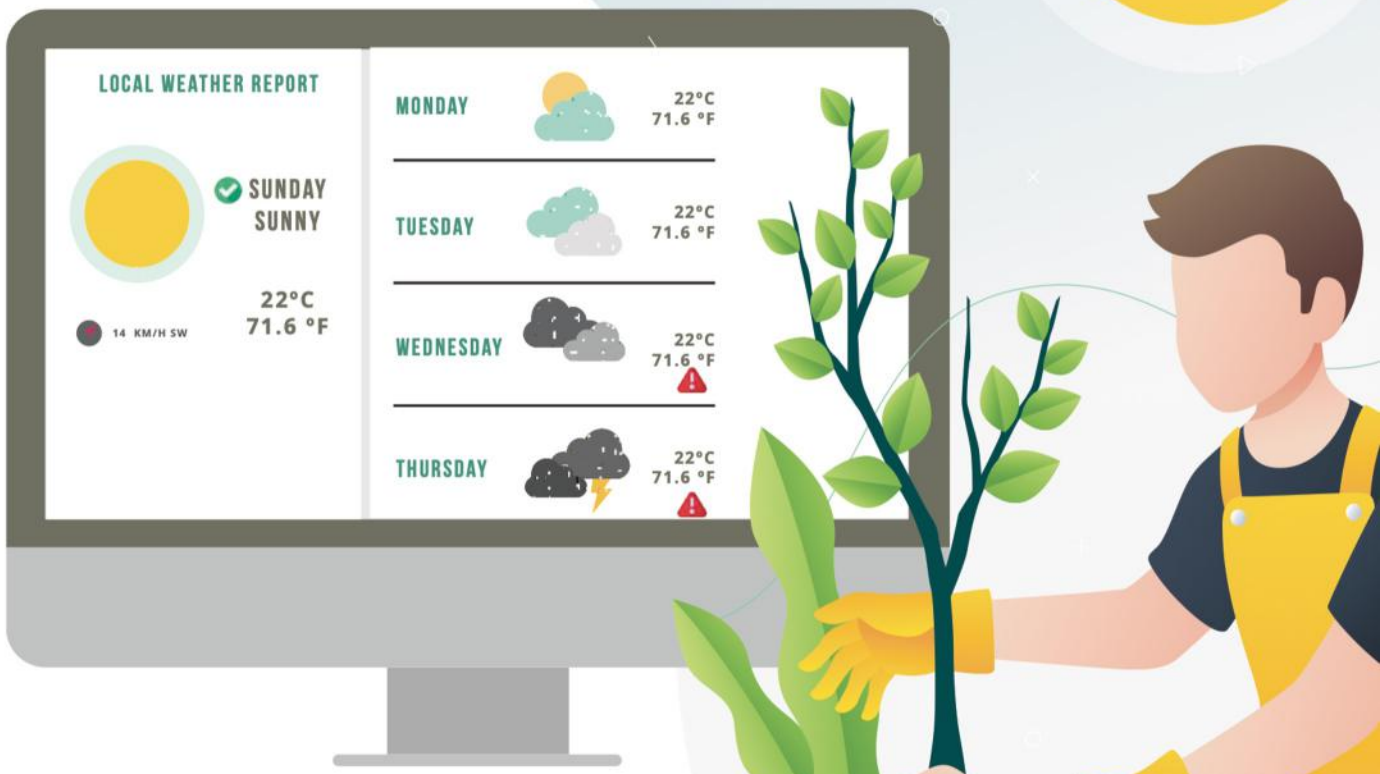
Wednesday 14/09/2022

Breakout session 1:30 pm - 1:55 pm

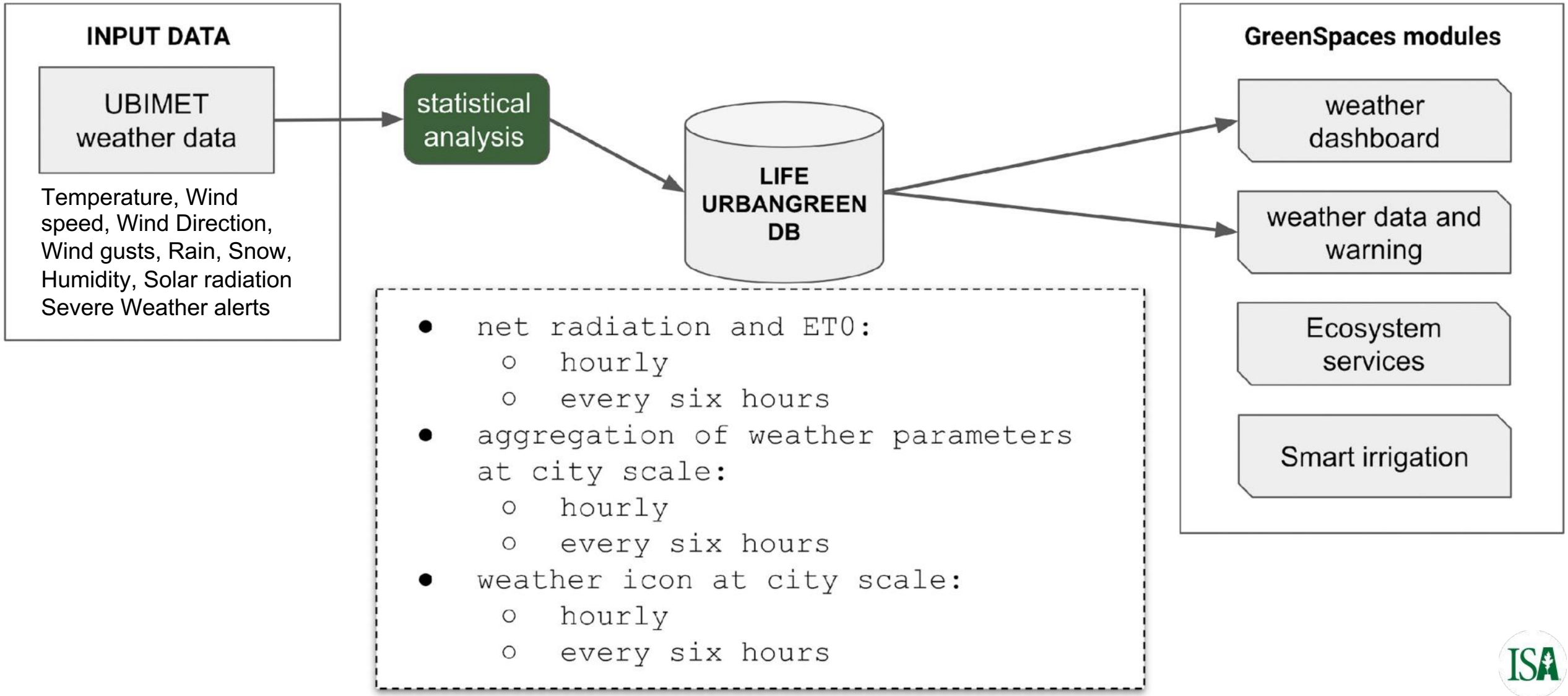
Room High Live 2

The software tools developed

Meteo dashboard and severe weather alerts

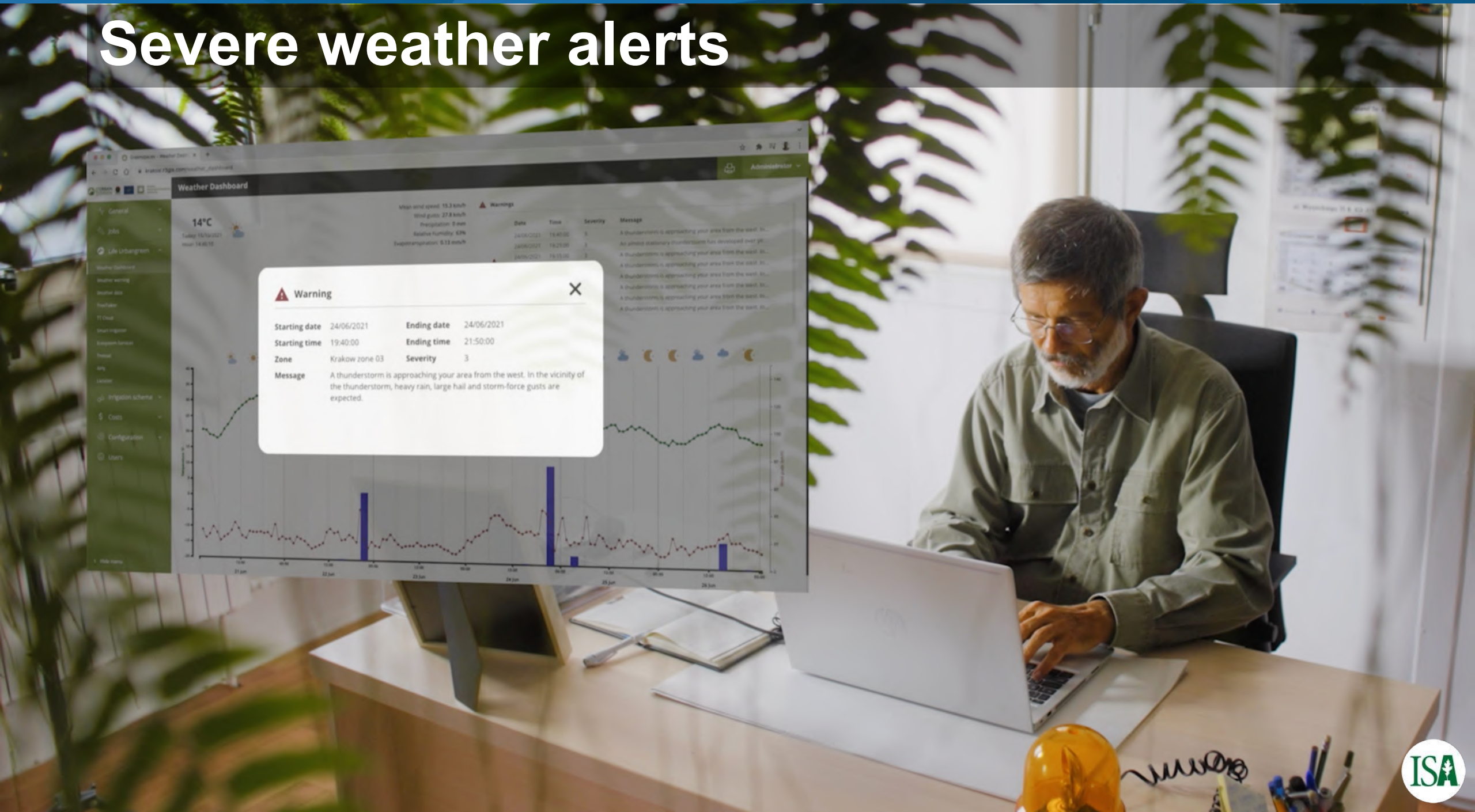


Weather data management

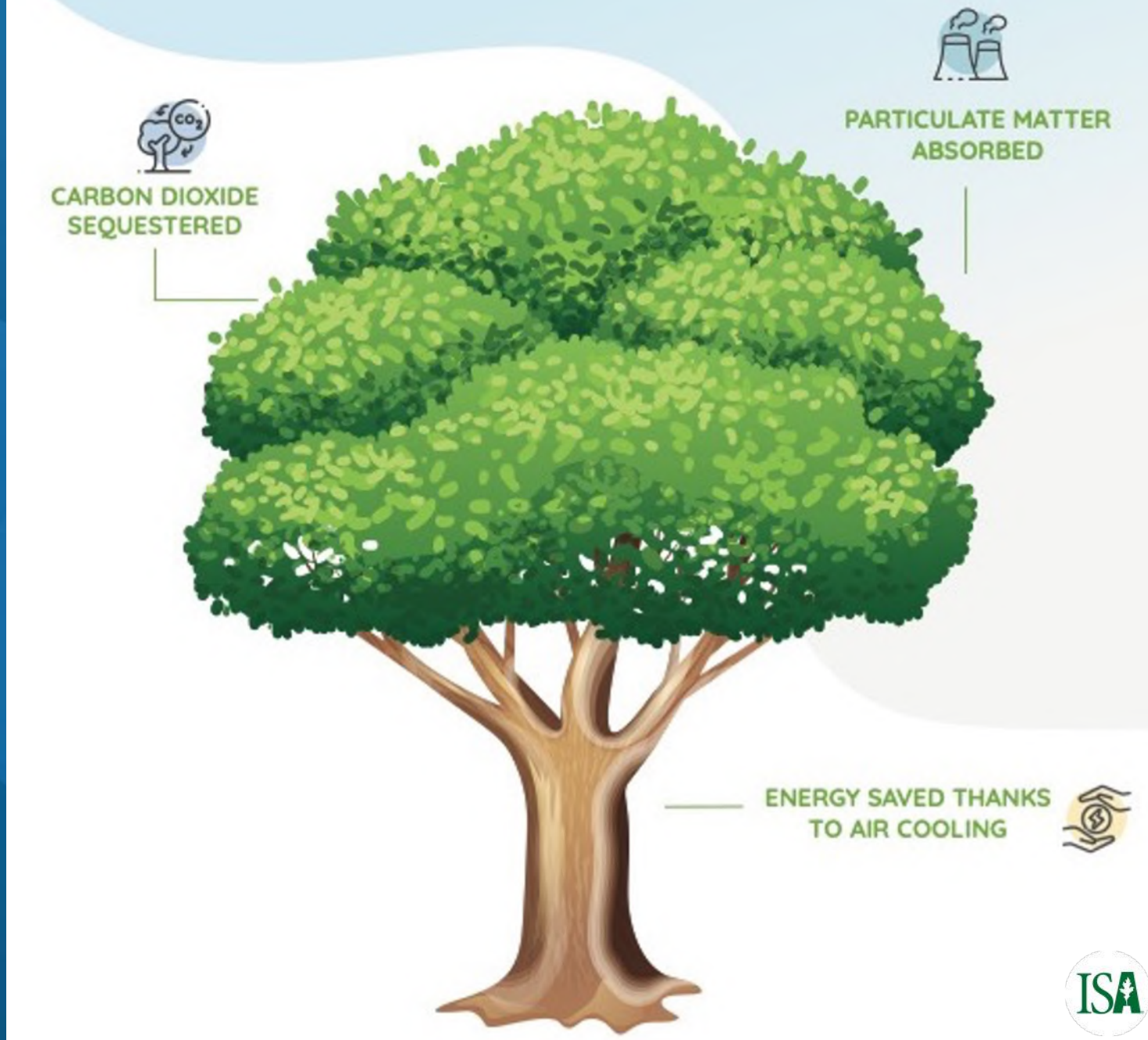


Weather dashboard

Severe weather alerts

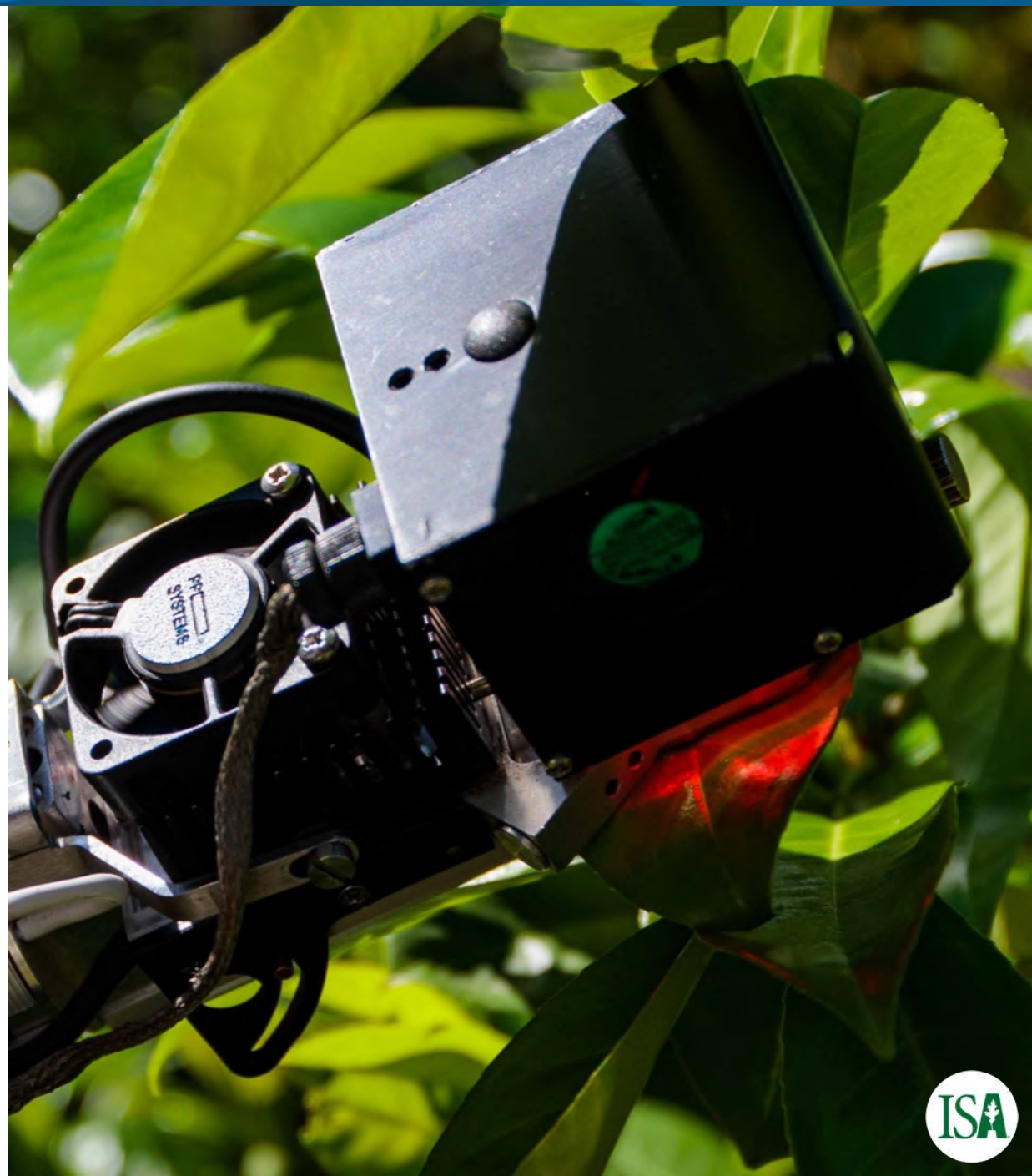


Calculation of benefits of trees



Measurement campaigns

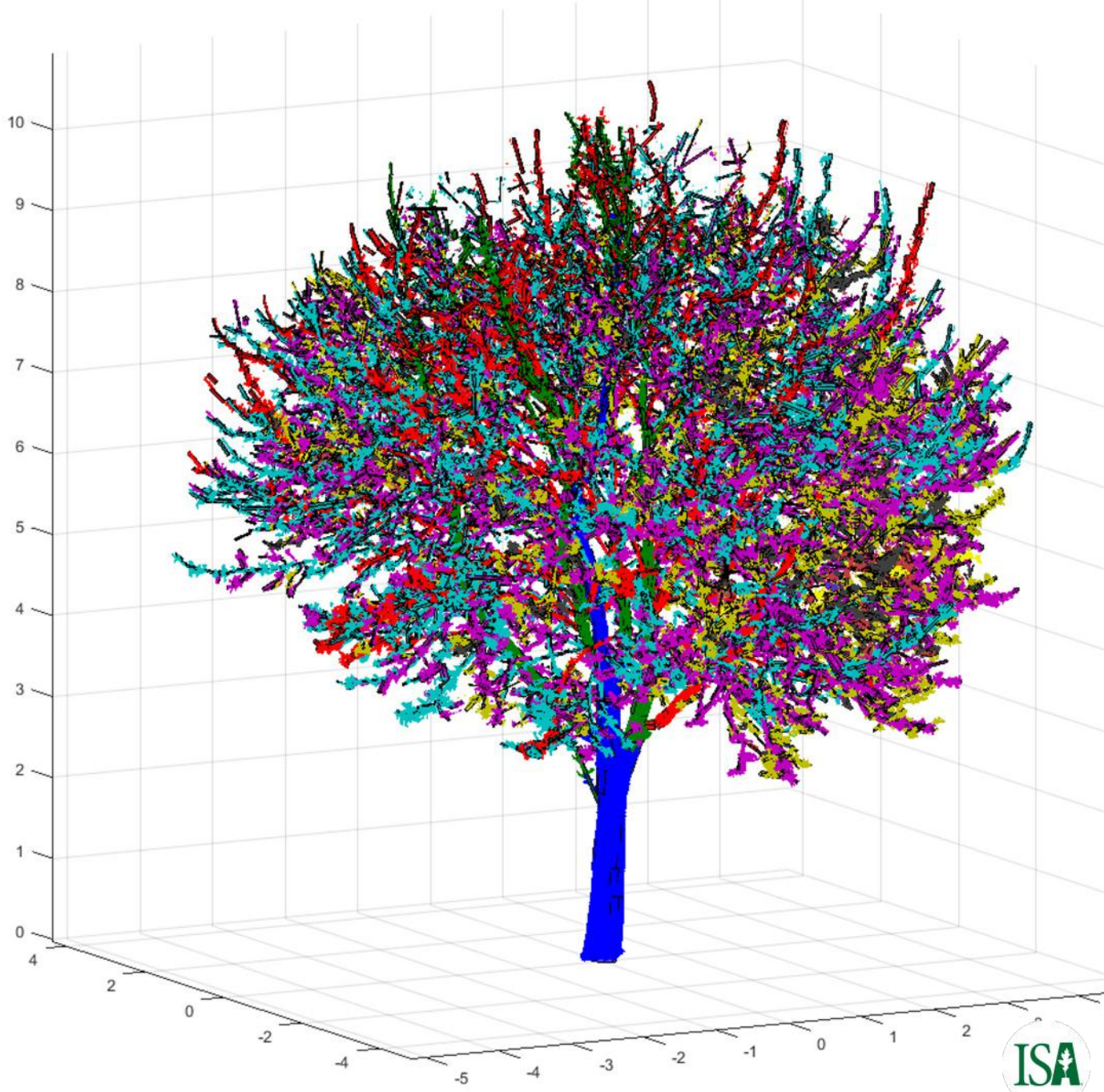
- 500 trees in Rimini and Krakow
- Four growing seasons (2018-2021)
- 17 species (10 Rimini, 10 Krakow, 3 common)
- more than 50% of the tree population of the two cities
- Leaf transpiration was measured to derive CO_2 adsorption and water transpiration
- LAI was measured by means of radiometric method



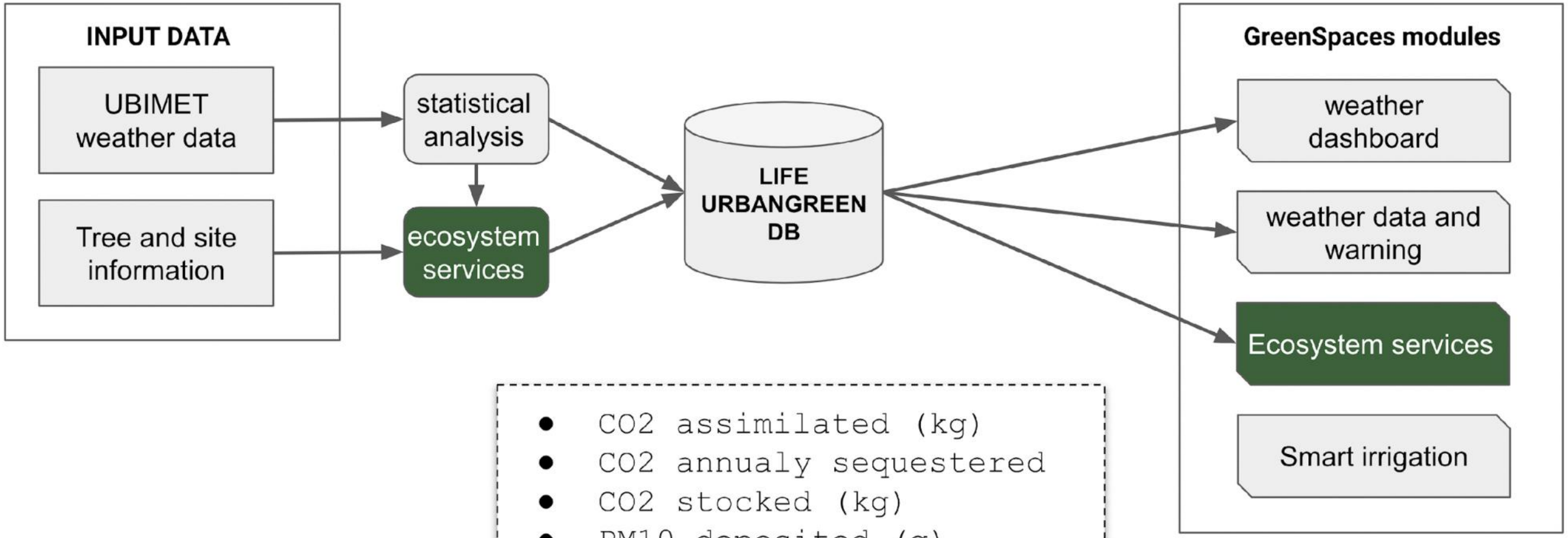
LiDAR TLS surveys

Accurate LiDAR measurement on selected trees was used to derive trunk volume, total leaf area and its distribution at different heights.

In addition, leaf samples were collected and analyzed in laboratory for deposition of pollutants (PM_{10}, $PM_{2.5}$).

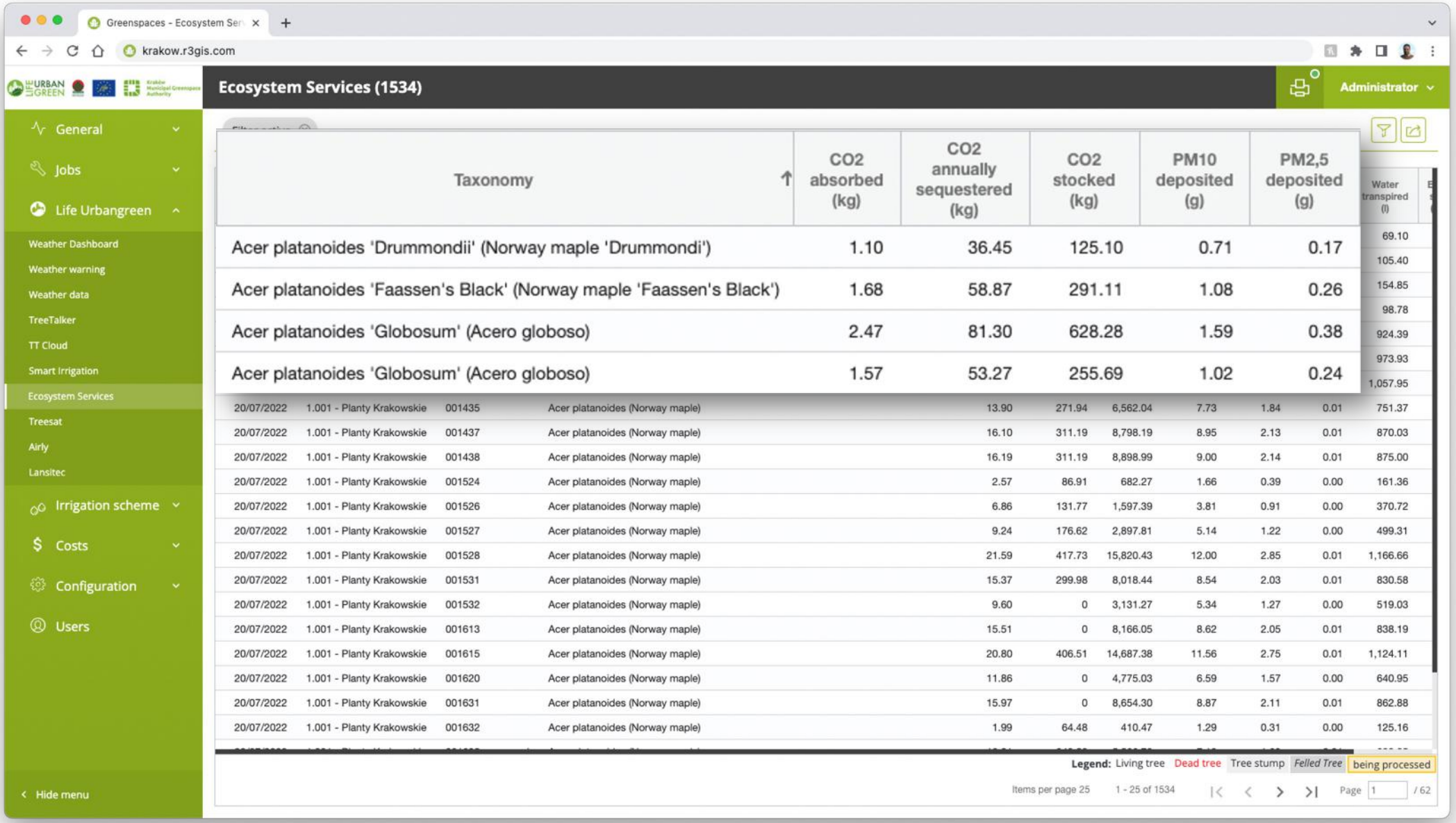


Ecosystem services calculation



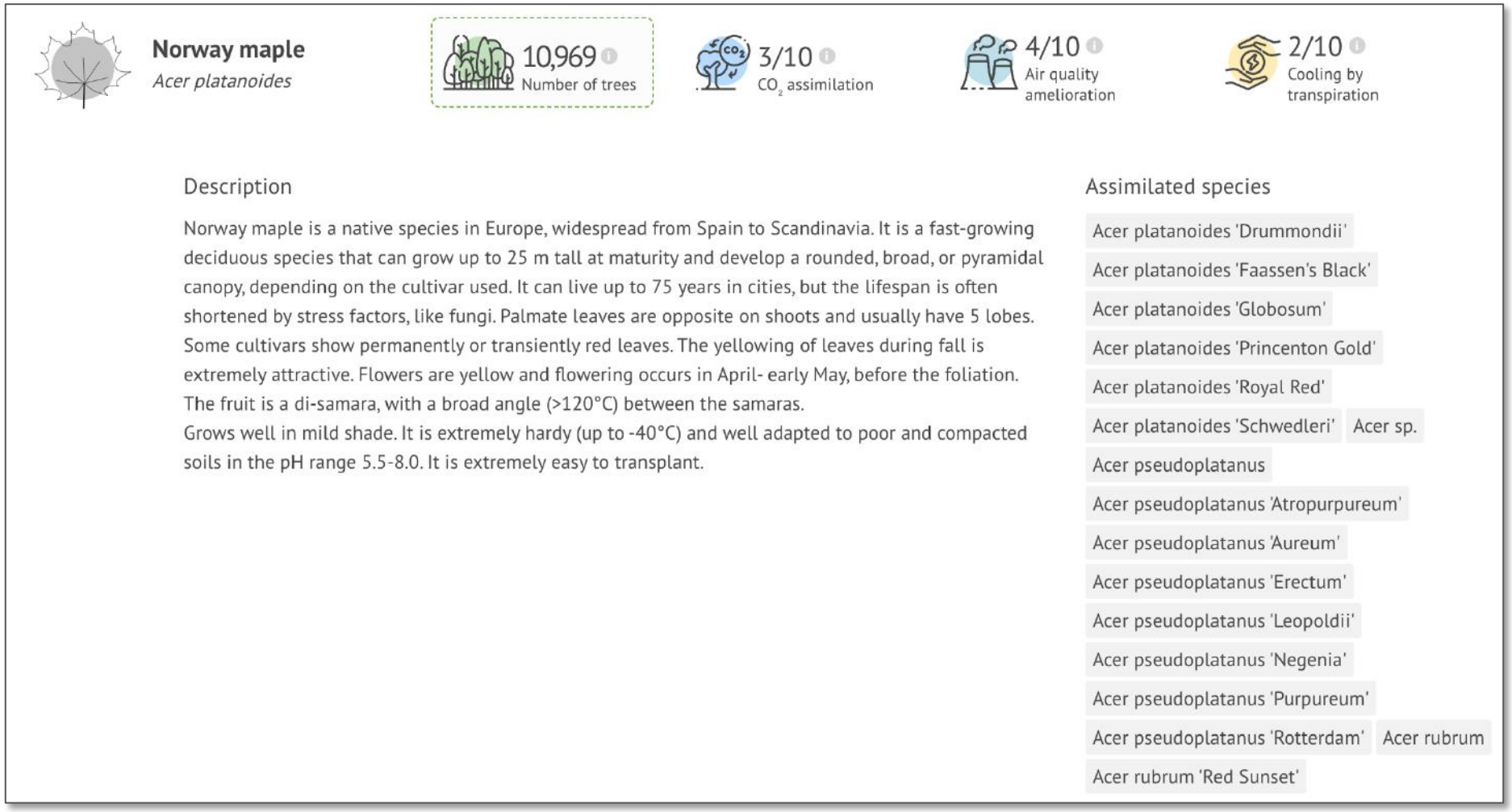
- CO2 assimilated (kg)
- CO2 annualy sequestered
- CO2 stocked (kg)
- PM10 deposited (g)
- PM2,5 deposited (g)
- Water transpired (l)
- Energy saved (kWh)

Tree benefits

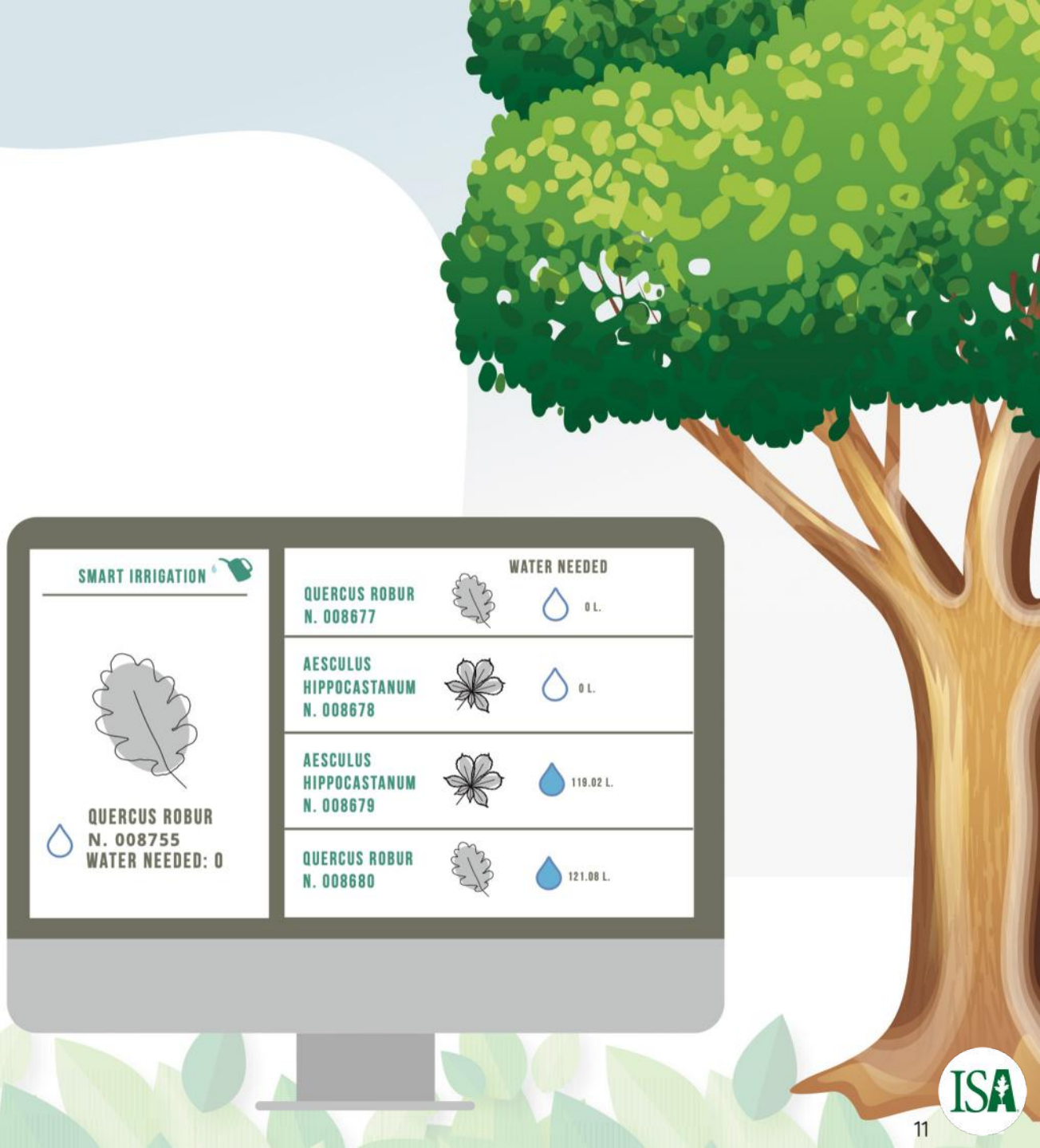


Tree benefits

Benefits extended to other species with similar behaviour:

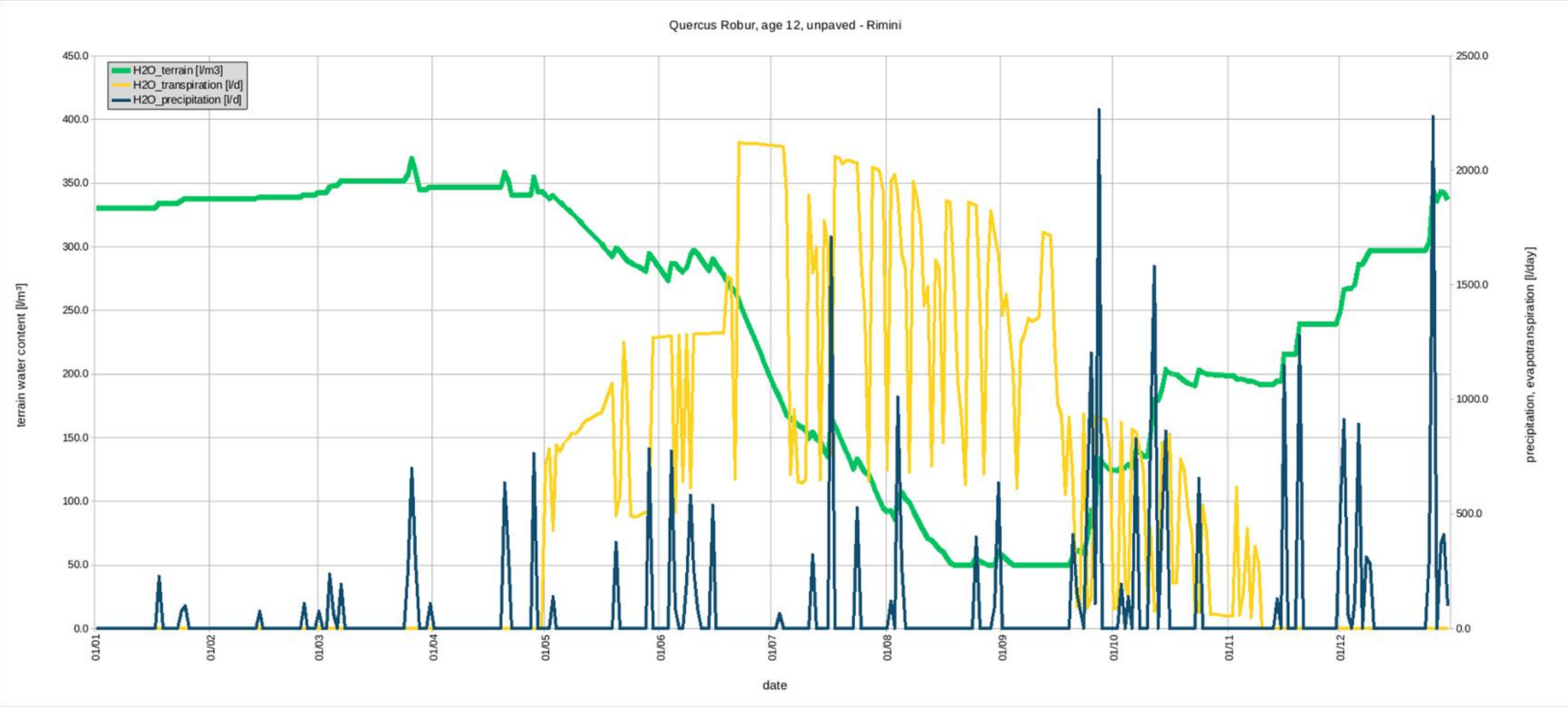


Smart irrigation tool

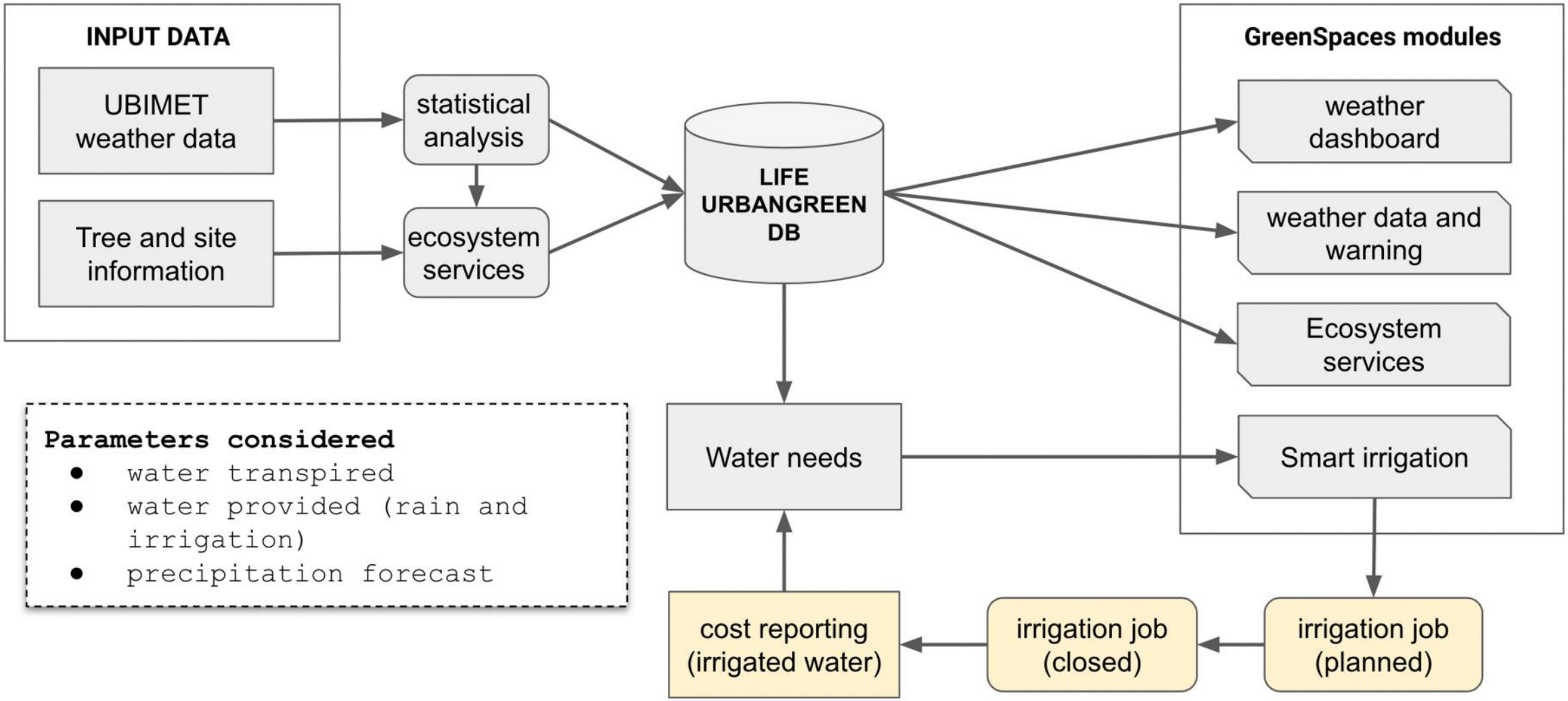


Smart irrigation

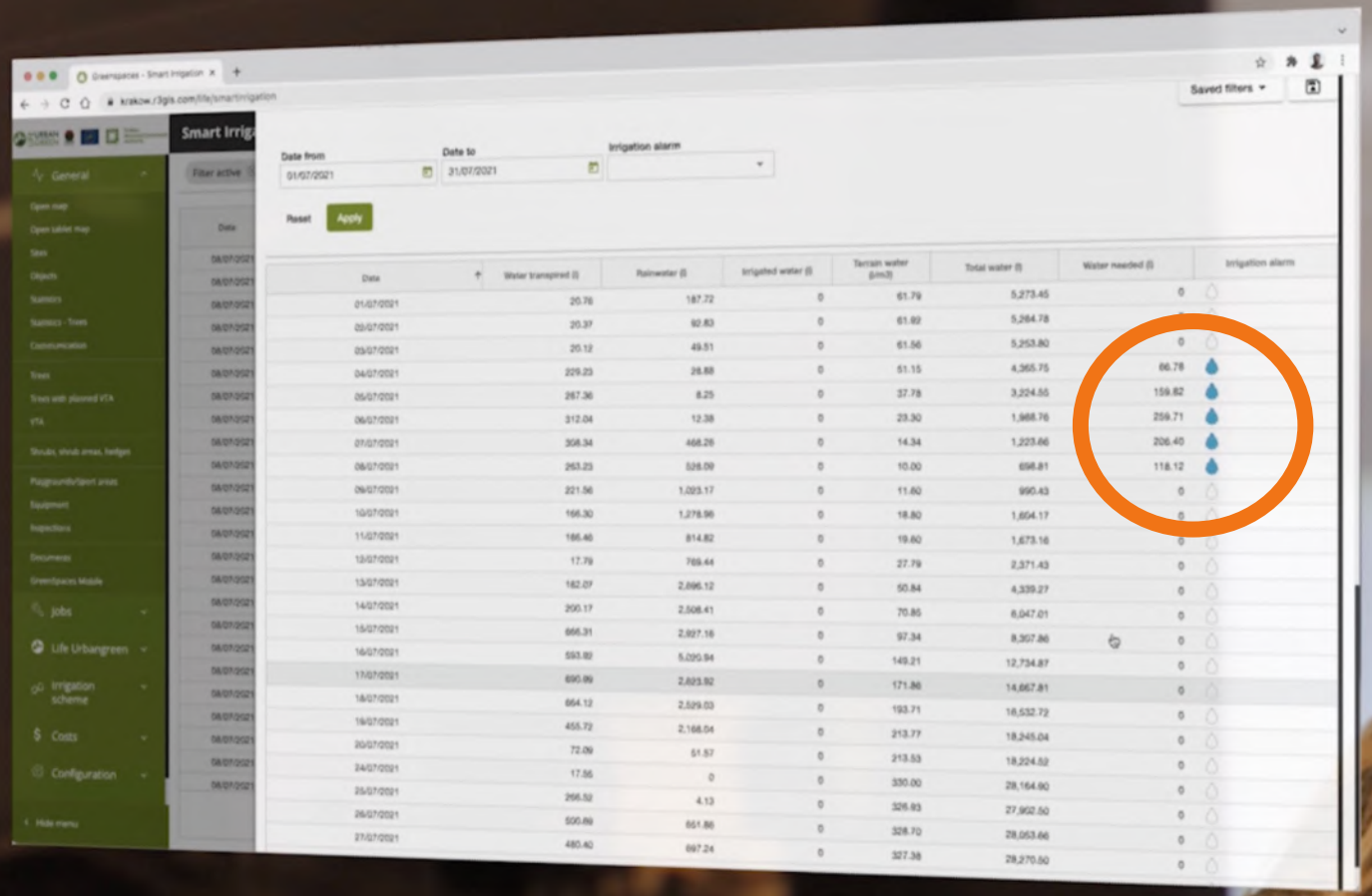
With transpiration, precipitation and irrigation GreenSpaces calculates the water available to the tree and when a tree needs water



Smart irrigation

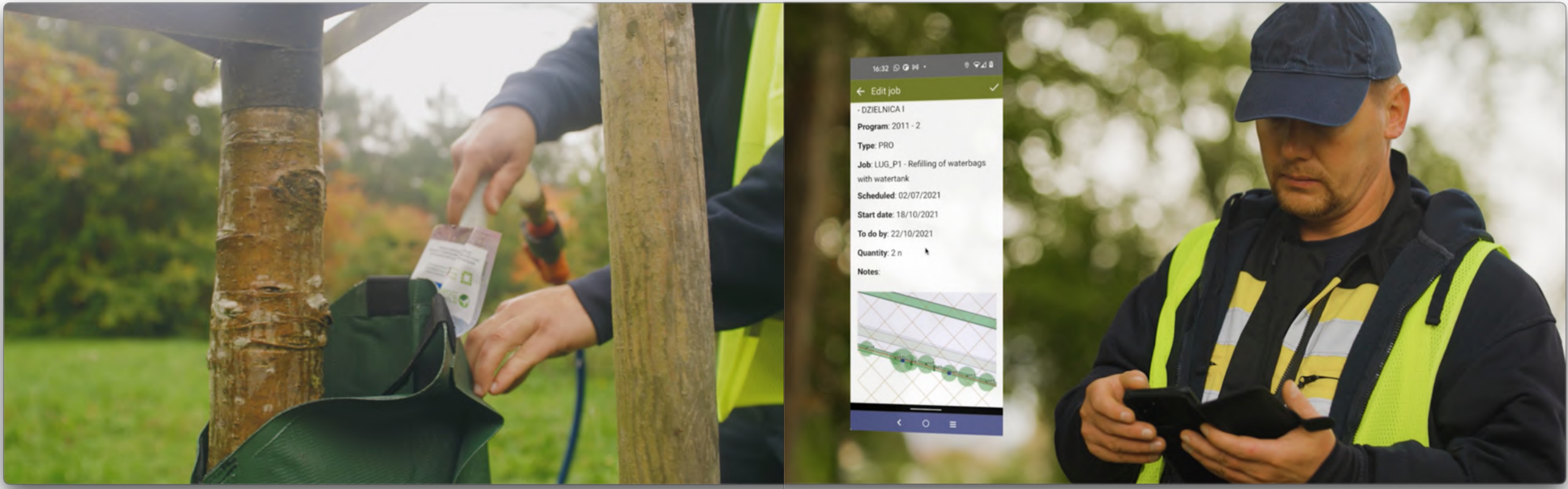


Smart irrigation



Smart irrigation

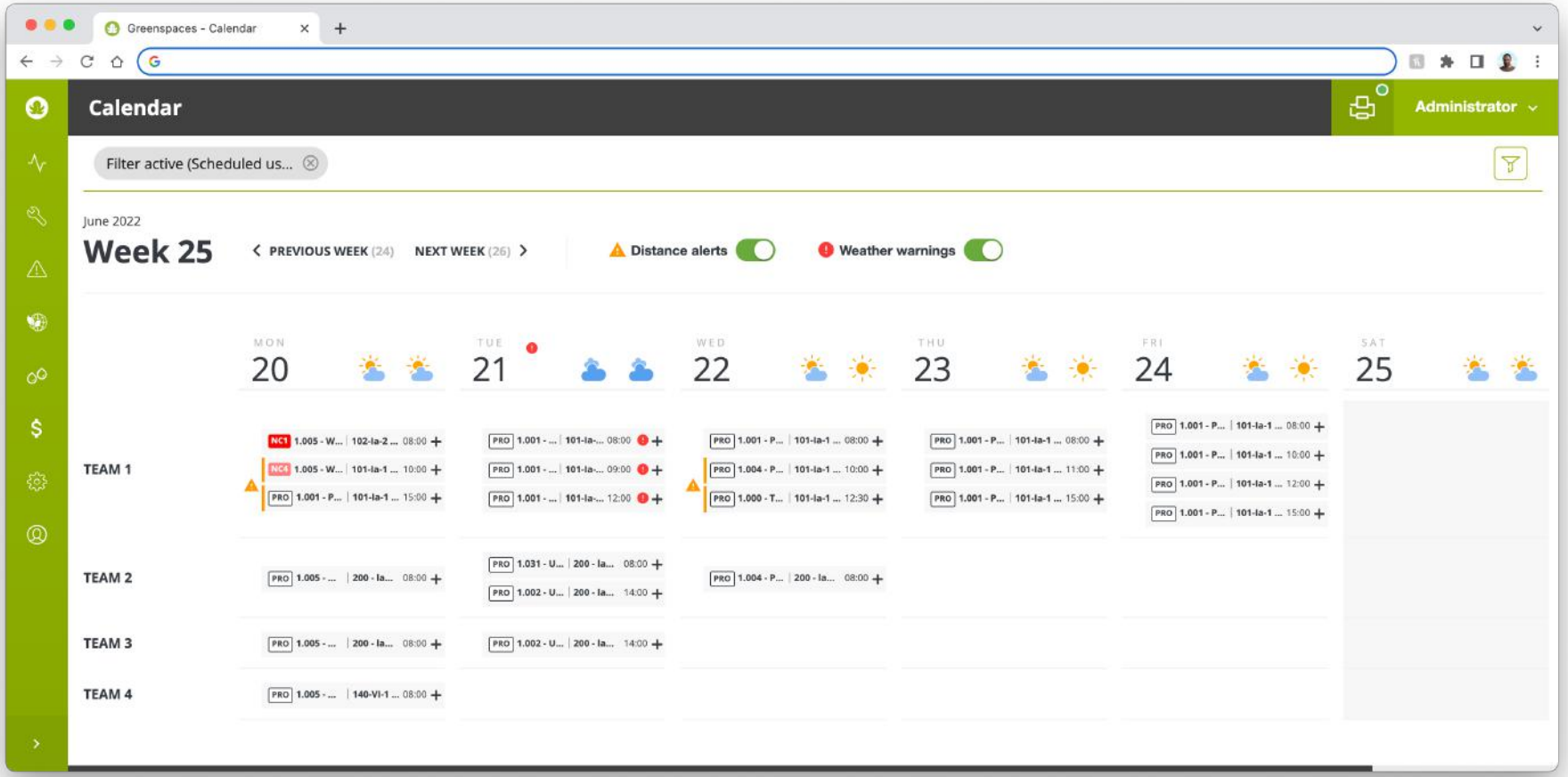
Based on the calculations of the smart irrigation tool trees are watered and the delivered amount of water is recorded.



Efficient planning of care and maintenance activities

Smart job scheduling

In order to make maintenance more efficient and reduce the carbon footprint, tools have been developed to schedule jobs considering weather forecast and distance between sites.



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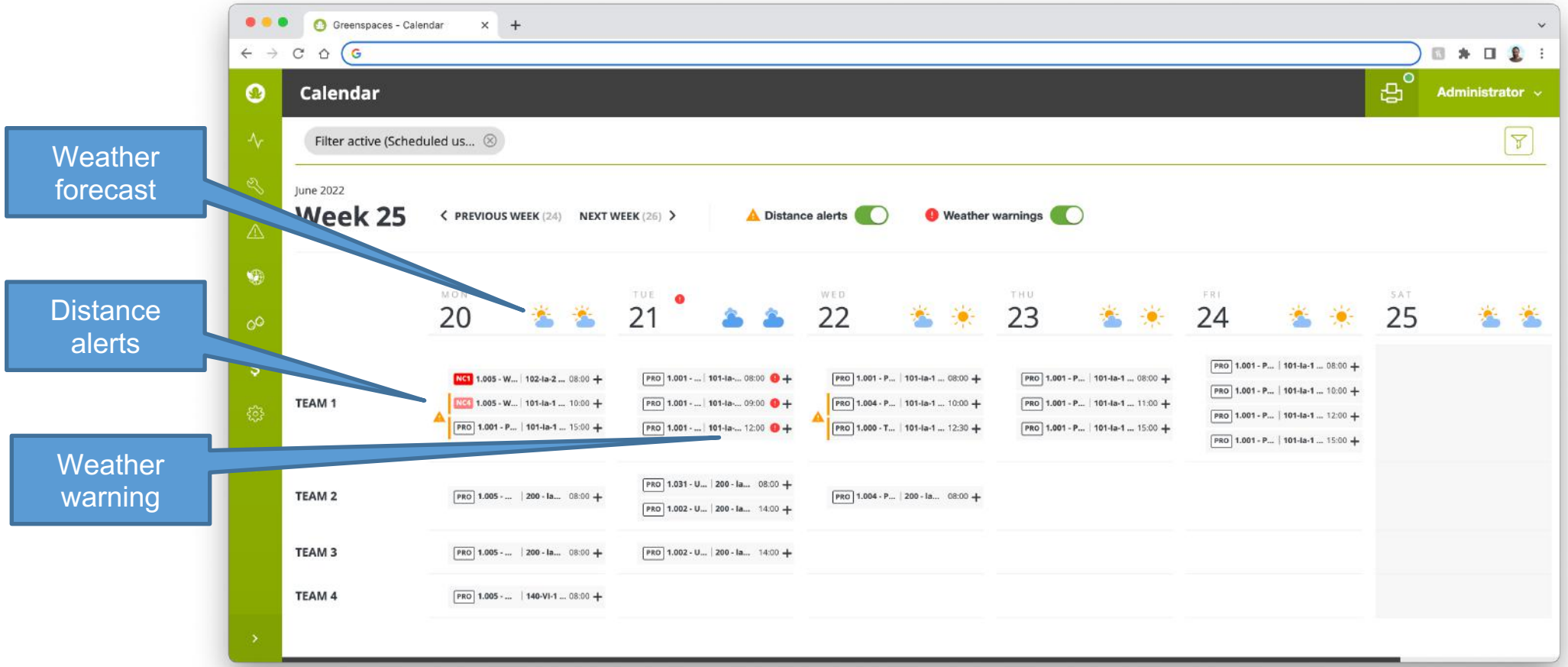
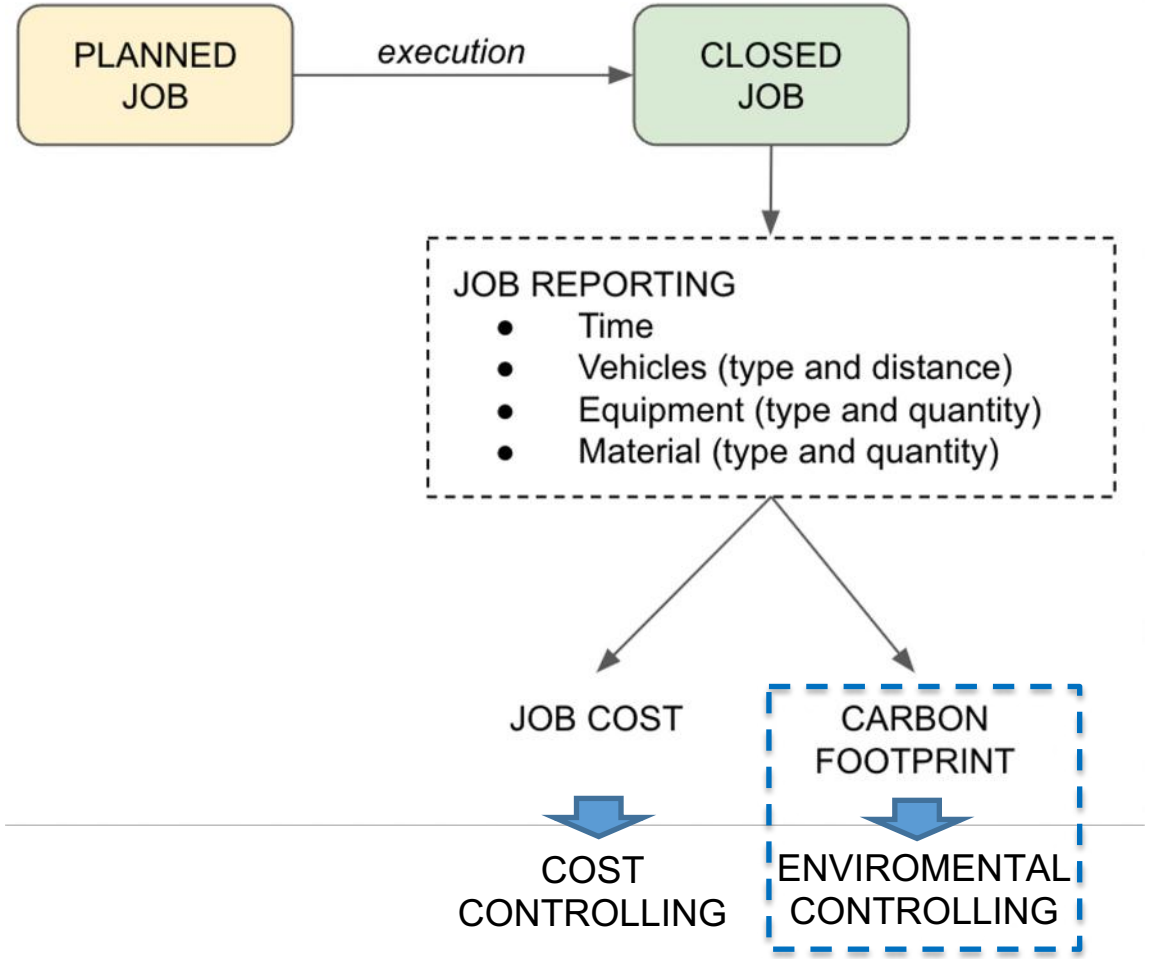
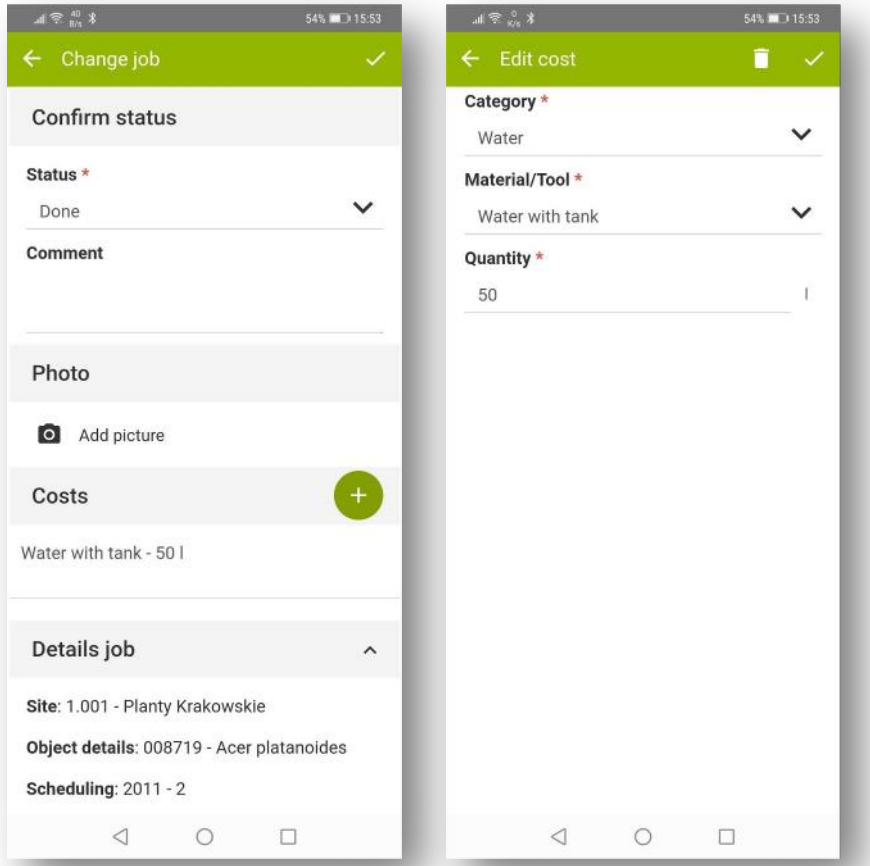


Cost controlling

Tools to record the effort and resources used to close a job and cost controlling by cost center -> reduce carbon footprint






16:32
4093
SITES
5
JOBS
0
VERIFY JOB
0
ISSUES
0
TREES
0
VTA
1455
0
alert
teams
priorities
penalty
operators
companies
schedule
prices
multiple
weather
planning
weekly
controlling
noncompliance
tenders

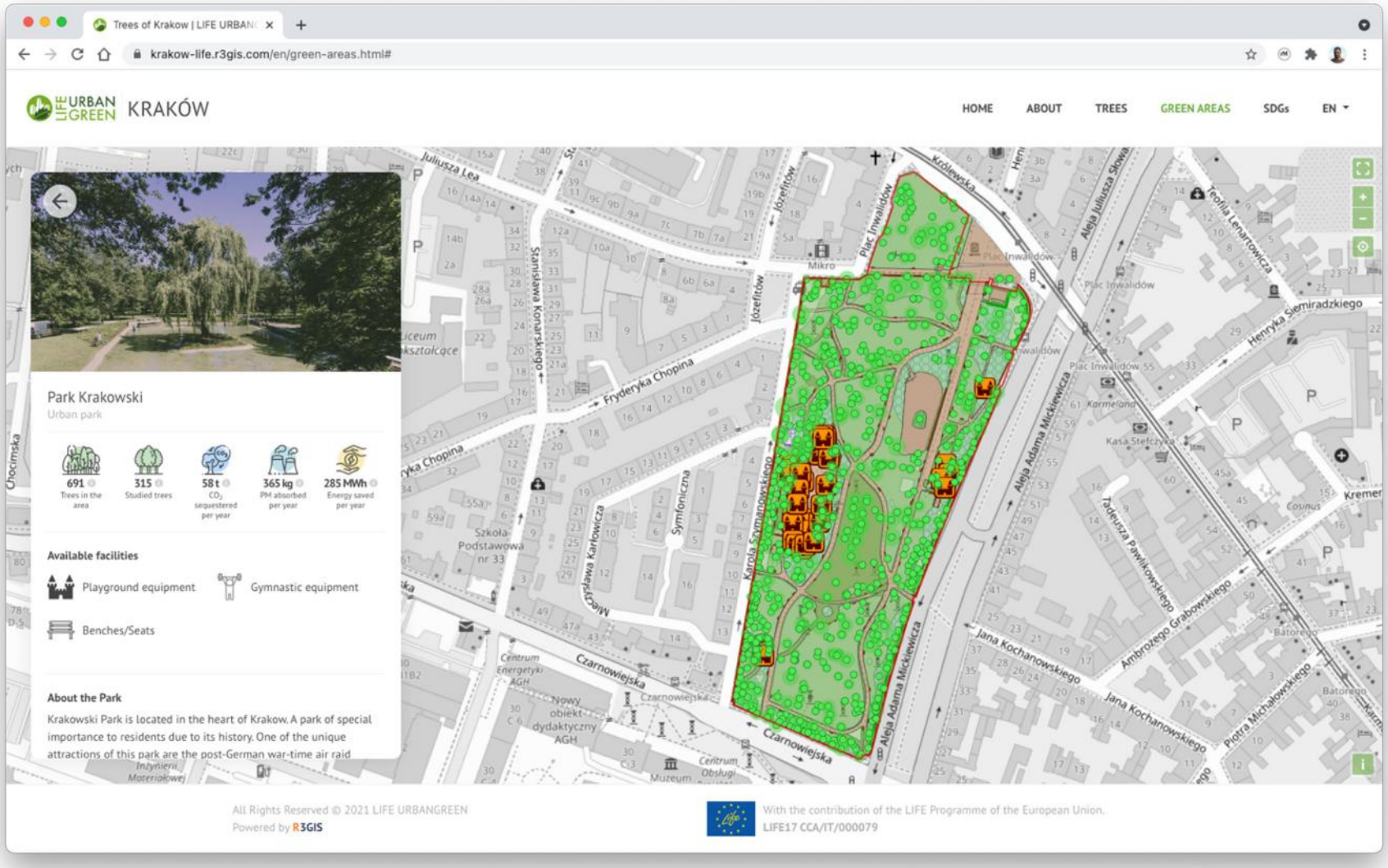
Integration of IOT sensors

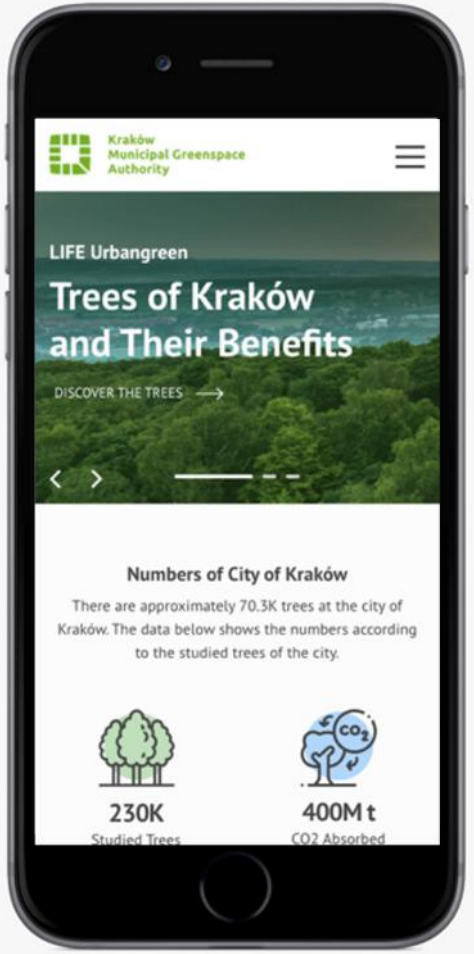
Environmental sensors

Several types of sensors were integrated into GreenSpaces to acquire environmental data and monitor variables as: air temperature, humidity and pollutants, trees radial growth, sap flow, stem position, light passing through the crown, etc.
Further activities are under way to use the sensor data to calibrate ecosystem services algorithms.

Engagement of citizens

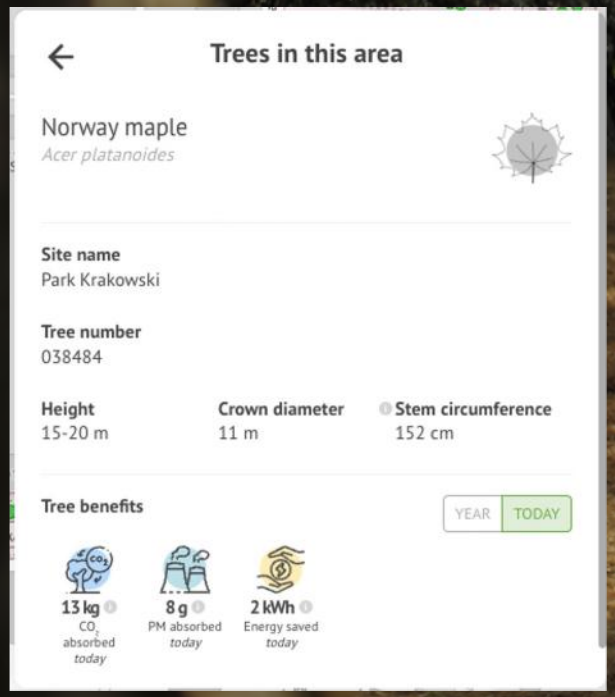
Public portal



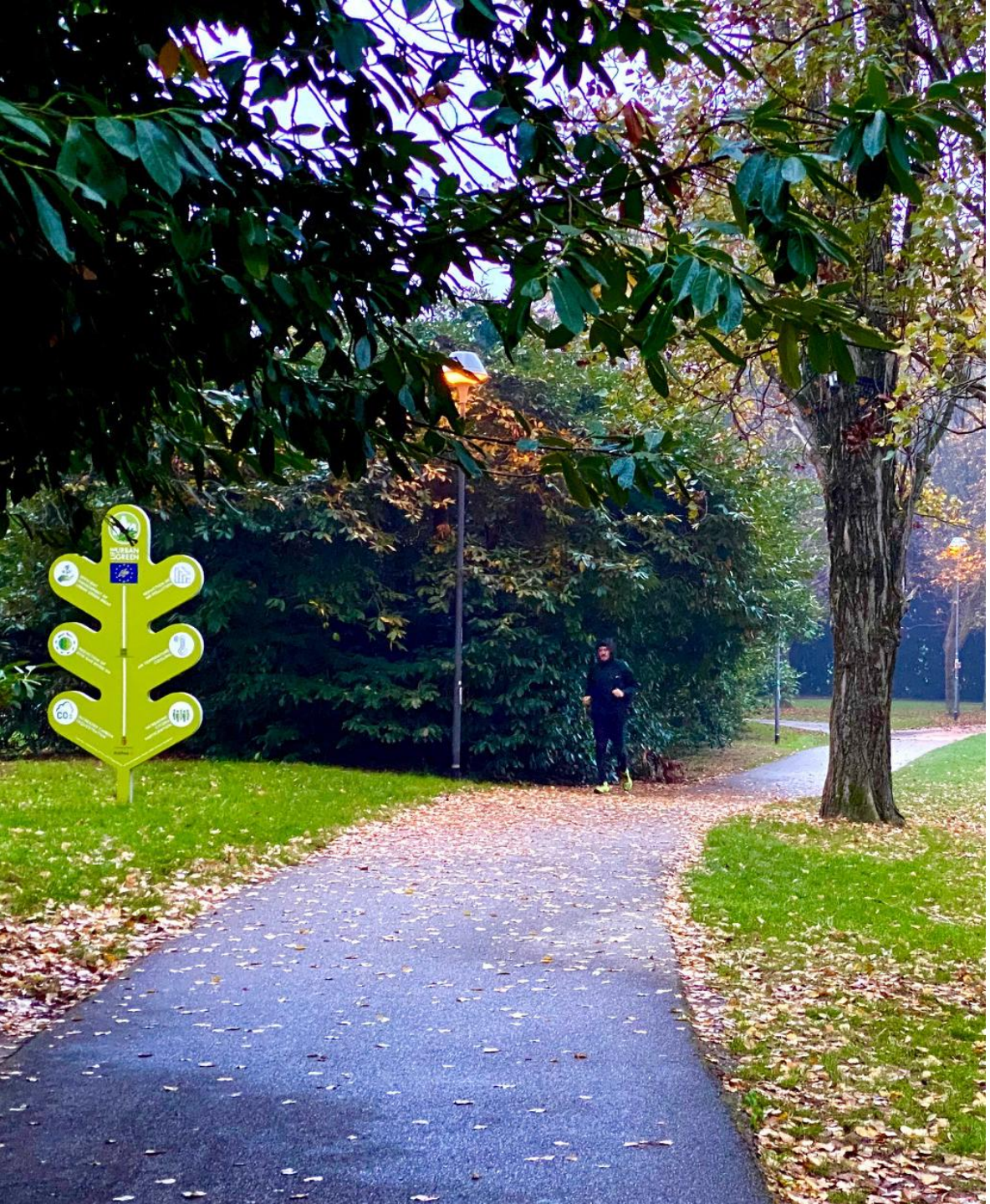


Public portal

Life update of green area census, tree inventory and ecosystem services on a daily basis.



Testing and demonstration on pilot sites



Pilot and control sites

The study areas in the two cities were divided into Pilot and Control areas.

Similar trees were selected in pilot and control areas and were measured during the first year as a baseline.

In Pilot areas best practices were applied:

- Target pruning, according to ETW standards
- Mulching on trees
- Soil aeration on compacted soil around the trees
- Irrigation to trees according to the smart irrigation module

In control areas trees were treated as usual, without particular attention.

Best practices

In pilot areas best practices were applied to ensure optimal conditions and ecosystem services maximization

TARGET PRUNING (ETW)

MULCHING

TREE IRRIGATION

SOIL AERATION

Best practices

In pilot areas best practices were applied to ensure optimal growing conditions and ecosystem services maximization. Differences in ES provisioning were measured at the beginning of the project and two years after application of the best practices. Average values for all studied species are given.

City	Rimini (I)			Krakow (PL)		
Ecosystem services (pilot vs. control)	1st year	2 years after imposition of treatment	**Difference**	1st year	2 years after imposition of treatment	**Difference**
CO_2 assimilation per tree (kg tree^{-1} day^{-1})	-2,4%	+21,9	**+24,3%**	-9,3%	+6,1%	**+15,4%**
PM_{10-100} per tree (g tree^{-1})	-5,7%	+14,9%	**+20,5%**	-17,8%	-5,3%	**+12,5%**
$PM_{2.5-10}$ per tree (g tree^{-1})	-7,8%	+23,8%	**+31,6%**	-14,4%	-3,3%	**+11,1%**
$PM_{0-2.5}$ per tree (g tree^{-1})	-24,4%	+9,5%	**+33,8%**	-19,3%	+0,5%	**+19,9%**

Outlook and conclusions


Interreg
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VERDEVALE
Metodi innovativi per la gestione e valorizzazione
del verde urbano e dei servizi ecosistemici
ISA

Conclusions

- The tools developed have been tested in Rimini and Krakow and are now being applied to other cities.
- Through LIFE URBANGREEN only a few ecosystem services were addressed for a limited number of species. More research is required to extend the algorithms.
- In the Verdevale project we managed to extend measurements to selected shrub and hedge species. We are working on further opportunities.
- Further developments are going on to integrate and make use of IOT sensor data and of remote sensing data.

THANK YOU!

www.lifeurbangreen.eu

www.r3gis.com/greenspaces

R3GIS managing spaces Anthea

Kraków Municipal Greenspace Authority

ProGea

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